

# Emergency Medical Support Units to Critical Care Transport Teams in Iraq

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The imagery of warfare has never been so easily accessible to the public. The sights and sounds of war can be viewed almost instantaneously on the evening news or seen on the Internet. The shadow of war has been cast upon several generations in the United States, but perhaps never with such immediate processing. Some of my earliest recollections of war were seeing clips of the Vietnam War on the daily evening news. Those news clips showed soldiers in the jungles of a distant land, carrying machine guns and helping their injured buddies. The news brought the grittiness of war into our living rooms. The carnage of war was tempered; however, the average citizen could recognize the destruction of battle.

A fascinating portrayal of the human aspects and impact of war came from one of my favorite television shows, *M\*A\*S\*H*. In the series, Dr. Hawkeye Pierce, a dedicated general surgeon thrown into the chaos and destruction of the Korean War, was my hero. Hawkeye questioned why he was in an operating room (OR) so far away from home, trying to piece together the young soldiers who met their fate on the battlefield, day after day. Nonetheless, he understood that he was there to provide much-needed care and he never wavered in his professional role. The patient was always his mental anchor during the

tumultuous situations he faced. The importance of having talented health care providers to save our soldiers was of great importance to him, a value that helped shape my interest in being a part of that wartime process.

## Expeditionary medical support system

In modern warfare, it is important to bring health care as close as possible to the battle, thus embracing the golden hour of trauma care. Expeditionary Medical Support System (EMEDS) is the relatively new building block of medical care provided in the combat zone [1]. Since the Korean War, sick and injured troops have been transported by helicopter from the battlefield to a location far behind the enemy lines. In these places, a Mobile Army Surgical Hospital (MASH) could provide care close to the battlefield, but at a safe distance. The Vietnam War adapted techniques used in the Korean War and perfected the “dust off,” an army aeromedical evacuation (aerovac) process of bringing wounded soldiers from the battlefield to field hospitals. However, because treatment at field hospitals during the Vietnam War was limited, critically injured military members were not transported until they were stable enough to travel. The level and location of care have changed since Operation Desert Storm in Iraq, during which medical services ascertained that for care to be effective, it needed to be offered closer to the combat zone [1].

To fit within the US Air Force (USAF) Air Expeditionary model of being lean and portable, the EMEDS concept was born. The need to get to a “hot” zone quickly and efficiently forced the

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USAF to develop a modular hospital that could flex up or shrink, based on the operational needs of a mission. It makes sense to bring only what is needed; bringing unneeded supplies and personnel is costly in time and resources. “The EMEDS concept is a phased-in deployment that develops into a theater hospital, with specialty care available in separate modular packages” [2]. Major General George Taylor, Surgeon General USAF, attributed the survival of 90% of injured combat veterans in Operation Iraqi Freedom to the EMEDS program [3].

### *Concept of operations*

The basic premise of EMEDS is to create building blocks of small medical care modules that can be quickly assembled and transported to a battle site. This modular approach allows the air force great flexibility in meeting medical needs in a field of operation and reduces the footprint of medical facilities. The different EMEDS modules include the EMEDS basic, EMEDS plus 10, and the EMEDS plus 25. The EMEDS basic module consists of a two-person preventive aerospace medical team and a five-person mobile field surgical team that make up a rapid response team [4]. The surgical team, which is one of first to deploy and arrive at a designated location, travels with its required surgical equipment in backpacks. They do not have tents, so they work out of a location of opportunity, converting any building into an OR [4].

Within 24 hours, the remaining 18 members of this unit arrive, bringing with them all the tents to construct the physical EMEDS basic module. Another 12 hours later, full clinical operations can start in the module, including aerospace medicine, preventive medicine, dental care, primary care, emergency care, critical care, and surgical capability [4]. The EMEDS basic module, which has limited inpatient beds, services a deployed military force of 500 to 3000 individuals. Because this module has a limited capacity for treating ill patients for more than 24 hours, rapid aeromedical evacuation is paramount to patient care [2]. The EMEDS basic unit can perform 10 major surgeries (using one table) or 20 nonoperative trauma resuscitations in 24 hours, with supplies and equipment to provide this capability once during a 7-day period [4].

If the site of operation requires more medical assets and resources, the next echelon of EMEDS modules is activated. The EMEDS plus 10 module increases inpatient beds by 10 by adding tents and personnel to enhance care capability [4]. The last level is the EMEDS plus 25 module, which has 25 beds and more than 80 personnel, and services a deployed military force of 3000 to 5000 individuals. This module provides 24-hour care for all emergency and ambulatory medical care in an interconnected tent structure (Figs. 1 and 2). The EMEDS plus 25 provides multiple medical services, including preventive medicine, trauma resuscitation and stabilization, limited general and orthopedic surgery (using two tables)



Fig. 1. Aerial view of 407th Air Expeditionary Group EMEDS.



Fig. 2. Hallway of 407th Air Expeditionary Group EMEDS.

(Fig. 3), critical care, primary care, aeromedical evacuation coordination, aerospace medicine, urgent care (Figs. 4 and 5), dental care, and laboratory and radiology services [4]. The EMEDS plus 25 is a small hospital with all the resources that one would find in an American hospital.

Having been deployed to work in both an EMEDS unit and its predecessor, the Air Transportable Clinic (ATC), I can verify that the EMEDS concept of operation and layout is extremely successful. When I was deployed in 1999 during the Kosovo crisis, I set up and worked in an ATC, which arrived as tents and medical supplies on several pallets. This ATC served as the primary emergency room (ER) and sick call clinic for all deployed personnel assigned

to the fighter wing, the air force equivalent of an army base. Capabilities were somewhat limited by today's military medical and nursing standards, which include advanced trauma capabilities and more medical personnel. With basic lifesaving equipment and medications in the ATC, we provided essential care to the deployed military members.

#### **Other roles of the Expeditionary Medical Support System plus 25**

The EMEDS plus 25 offers many medical services to the base and surrounding area. At the 407th Air Expeditionary Group (AEG) EMEDS where I was stationed in Iraq, the



Fig. 3. Table #1 OR 407th Air Expeditionary Group EMEDS.





Fig. 4. 407th Air Expeditionary Group EMEDS Emergency Room door.

laboratory and pharmacy and the radiology unit were visited by many ambulatory patients. These areas were well organized and coordinated to offer a high level of service. Not only did the EMEDS provide excellent medical and nursing care but also dental care. The dental clinic was sometimes the busiest location in the facility. We had two excellent dentists, one of whom was an army dentist on an extended tour, working side by side with air force personnel. The importance of dental health is important because dental problems can impact negatively on a military mission [5].

#### **Aerovac and the Critical Care Air Transport team**

Aerovac, whether it occurs on the battlefield, by helicopter, or by fixed-wing aircraft, certainly gets the adrenaline flowing. Not only has the military modernized its weaponry and changed the dynamics of the battlefield but it has also advanced its techniques for moving injured troops out of the combat zone. Patients are now being airlifted to more definitive care while still in critical condition. This expeditious medical evacuation ensures that injured military members receive the highest level of care as quickly as



Fig. 5. Emergency Room in 407th Air Expeditionary Group EMEDS.

possible. Resources for higher levels of care can be concentrated in identified locations within the combat zone or in a regional military medical center (ie, in Europe). This regional localization of larger medical facilities allows smaller facilities to provide stabilization closer to the combat zone.

During aerovac of injured troops, critical care is provided by Critical Care Air Transport (CCAT) teams, which consist of a critical care physician, a critical care nurse, and a cardiopulmonary technician [6], with skills that may be found in the most advanced ICU in the United States. The team is responsible for monitoring and managing patients who require intensive care as they are being transferred to the appropriate level of medical care [7]. These teams are capable of working on several different aircraft and they can transform any aircraft into a mobile critical care unit (Fig. 6) [1].

CCAT team nurses can make a vital difference in the airborne environment, combining their critical care competence with knowledge of flight physiology to enhance patient outcomes [6]. Regarding flight physiology, one must keep in mind the nine stressors of flight: hypoxia, fatigue, changes in barometric pressure, effects of gravitational forces, noise, thermal stresses, vibration, fluid redistribution, and dehydration [8]. Deployed medical teams provide essential care in the field and depend on rapidly evacuating patients in stabilized rather than stable condition [9].

Preparing critically ill patients for movement to another medical facility takes a great deal of coordination. Just as the outgoing shift of hospital nurses reports on patients to nurses on the incoming shift, EMEDS nurses report on patients being transitioned to CCAT teams. Many patients are brought into the ER with their body armor

and weapons. Nurses must ensure that patients are transported with their belongings. However, they must pay close attention to the transport of any weapons because weapons are not allowed in the open bay on the aircraft and must be secured in a locked container. In addition, nurses have to check that patients have an adequate supply of all medications and drips to cover possible rerouting of the aircraft and delayed arrival at the medical facility. Finally, all inpatient records and reports need to be sent to ensure a seamless transition of medical care and continuity of treatment.

### Trauma training

To prepare for working in a war zone, military health care providers train in busy trauma centers all over the United States [3]. Not only do military providers benefit from caring for trauma patients in civilian settings but they also have the opportunity to train on high-tech simulated patients (eg, mannequins) in a controlled setting. This preparation enhances the capability of every medic who will encounter trauma in the combat zone [3].

### Clinical experiences

At 0230 the call came in. A patient who had a severe gunshot wound was en route to the medical facility. The patient was hypotensive and tachycardic at the scene, where he had sustained an AK-47 gunshot wound to the lower leg. Blood loss was significant. When he arrived in the trauma room, he still had the intravenous (IV) fluid running that was started in the field, and his blood pressure had improved, although he was still tachycardic. During a primary medical survey, a blood-soaked field dressing on his lower



Fig. 6. C-130 takeoff from Tallil Air Base, Iraq.

calf was removed. Underneath the dressing, a large portion of calf muscle was blown out, leaving a gaping wound with small capillary bleeding.

A second urgent call came into the trauma room. Another gunshot injury was rolling through the ER doors. This patient was brought into the treatment facility by his buddies, who had witnessed the injury. The patient's left arm showed an obvious deformity with a small circular entry wound. Radiographs confirmed a shattered radius and ulnar, with displaced fractures and scattered bone fragments, and a 45-caliber bullet in the soft tissue.

#### *Center for Sustainment of Trauma and Readiness Skills*

Were these casualties due to sniper fire in Baghdad? A firefight in Afghanistan? Guess again. These wounds were sustained by civilians in St. Louis, Missouri. These are just two real-life cases I experienced during a rotation at St. Louis University Hospital with the Center for Sustainment of Trauma and Readiness Skills (C-STARS) program. In the C-STARS program, military medics are seamlessly integrated into the trauma service of the medical center. Military physicians and midlevel providers serve as house staff on the trauma service, and nurses work in all critical care areas. Emergency medical technicians perform in the ER and on ambulances. Military medics at all levels have ample opportunities to participate in several procedures in the trauma room, ICUs, and the OR. (Incidentally, "medic" is a term of

endearment and a label worn proudly by most military health care providers, including doctors, nurses, emergency medical technicians, and other allied health care members.) This program provides medics an authentic and meaningful exposure to significant trauma care, thus preparing them for trauma-related injuries that they are likely to see in the EMEDS.

C-STARS trainees at the St. Louis University School of Medicine also sharpened their skills in simulation laboratory exercises conducted in a state-of-the-art simulation laboratory. Mannequins representing patients were programmed to respond to medical treatment (real IVs, oxygen, and medications) by either improving or decompensating. This training laboratory mimics a trauma room in an EMEDS unit to give trainees the look and feel of how they might be working when deployed. An important aspect of the training was orientation to EMEDS equipment, some of which is unique to this military environment.

#### **Deployment setting in Iraq**

The EMEDS plus 25 to which I was assigned was part of the 407th AEG in Tallil, about 200 miles southeast of Baghdad (Fig. 7). The USAF integrates all facets of its available forces, Active Duty, Guard, and Reserve, into its war fighting plan. As a traditional Air National Guardsman, I was stationed with active duty air force personnel in Iraq. Although I was the only member of



Fig. 7. 407th AEG EMEDS "motto" sign, Iraq.

the EMEDS direct patient care staff not to come from an active duty hospital, my integration into this active duty team was successful in every aspect.

While I was working in the EMEDS in Iraq, my clinical experiences varied day to day. Assigned as a nurse practitioner in the ER, I worked with my collaborating physician to provide sick call, which involved urgent and emergent care for all personnel assigned to the base or within our geographic treatment zone (Fig. 8). The clinical situations ranged from coughs and colds to mass casualties with critically injured patients. Our EMEDS had two ambulances that met the army dust-off choppers at their landing zone close to the EMEDS facility (Figs. 9 and 10). The ambulances were also used to transport critically injured patients to the flight line or tarmac, for transfer to and from awaiting aircraft. We were very lucky that our EMEDS module was connected to a trailer with bathrooms for staff and patients. My background in critical care and my experience as a clinical nurse specialist in dialysis and transplantation became valuable when a continuous veno-venous hemodialysis (CVVHD) program was being established in one of the regional theater hospitals in Baghdad. I worked with the nurses by e-mail and phone because this CVVHD machine happened to be one I had used to train ICU nurses in the past. I was able to provide them with some expertise by developing some training materials as they were getting started.

### Patient populations in the combat zone

Working in the ER of the EMEDS gave me the opportunity to care for people from all branches of the armed services, in addition to Department of Defense civilian personnel, local civilian workers, coalition forces, and locals with emergent medical situations. One example of the last was a local 8 year-old girl who had been bitten by a venomous snake [10]. When she arrived, her condition was critical and deteriorating quickly. With her mother and translator, who was an English teacher in the Iraqi school system, by her side around the clock, she received the best medical care that the USAF could offer and made a full recovery. This example underscores the importance of health care providers' cultural competence. The support from her family and community was tremendous. The staff at the EMEDS became local heroes, but the real hero was the little girl who braved more than 2 weeks of aggressive medical treatment without any complaints. This clinical situation provided some first-hand experience with the surrounding community, whose acceptance of our work was gratifying.

### Clinical situations in the combat zone

#### *Situation #1*

Within the first few days of arriving in Iraq and before I had adjusted to the hot temperatures of the desert, I experienced my first mass casualty

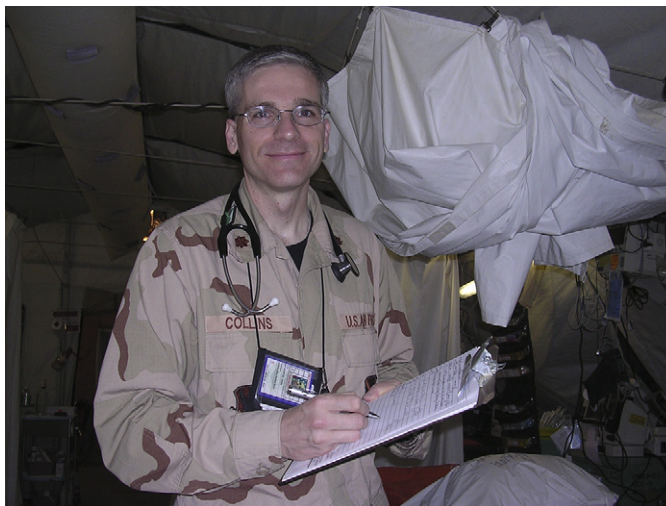


Fig. 8. Working in ER in EMEDS.





Fig. 9. Awaiting army dust-off chopper.

alert. Two hours earlier, I had left work to go to the air base library to write a paper for a course I was taking at University of Massachusetts, when I heard the commotion of trucks and choppers overhead. Whether from gut feeling or just curiosity, I was drawn to return to the EMEDS unit to see what was happening. Indeed, preparations were underway to prepare for mass casualties. The ER was being transformed before my eyes from a four-bed evaluation station into an open bay trauma room. The teamwork and precision of these preparations were only outdone by the care delivered when the patients arrived.

Because most of the trauma included shattered bones requiring a high level of expertise, the orthopedic surgeon was always in high demand.

Our trauma training was now fully activated to perform primary and secondary surveys rapidly. Although the environment was new for all members of the health care team, we performed our tasks like a well-practiced sports team. Blood was drawn, spun, and analyzed. Radiographs from stretchers were taken, one after another. Multiple patients were simultaneously and rapidly intubated and stabilized. Burn dressings were applied and vasoactive medications infused. Several



Fig. 10. Supporting army medic chopper, Tallil, Iraq.

patients were admitted to the ICU. Almost immediately, the flight surgeons began coordinating the intricate aeromedical evacuation system. This system ensured that critical care staff was available to provide complex medical care en route to seriously injured troops as they were being transported to more definitive care at a regional medical facility, usually in Germany.

One memory that will never leave me is carrying the stretcher of a critically injured soldier into the open bay of a C-17 cargo plane, because just the night before he and other critically injured troops had first rolled through the ER doors and had been resuscitated. These troops were departing while on ventilators and vasoactive medications. A detailed report was given to the CCAT team that took over the care of these patients. Two critical nurses helped to ensure that all equipment was working properly and secured. I waited in the ambulance on the flight line until the plane became airborne. If the plane had to abort its mission, we had to be prepared to transport patients back to the EMEDS ICU quickly.

#### *Situation #2*

The door of the ER was flung open, and a fellow airman uttered a dramatic cry for help. Several medics working in the ER ran out to assist him. Moments later they rushed through the door carrying a litter (stretcher) with a critically injured airman. The ER was instantly set into motion for transformation. The patient was conscious but had significant upper body burns with possible upper airway damage. The ER team rapidly sedated and intubated the patient and began fluid resuscitation before he was transferred to the ICU (Fig. 11). This airman urgently needed to be transferred to more definitive care for upper body and inhalation burns, so the flight surgeon initiated coordination of the CCAT team transfer.

#### *Situation #3*

Another mass casualty alert and we prepared for the arrival of patients. Some medics at the scene relayed that a critically injured airman was pinned in wreckage and was being resuscitated in the field. He arrived in dire condition with shattered legs, and the extent of his orthopedic injuries was visually devastating. Another two patients were brought in with multiple injuries, but our first patient was in the most critical condition. The physical layout of the EMEDS was solidified as this patient was intubated and



Fig. 11. Burn patient in 407th EMEDS ICU.

resuscitated in the ER and then wheeled on his stretcher 30 feet back into the OR. The OR team worked with great urgency to prepare all the equipment and supplies necessary to save this man's life. The orthopedic surgeon spent several hours attempting to salvage the patient's badly damaged legs. The OR nurse and nurse anesthetist worked feverishly, providing blood transfusions and fluid resuscitation and maintaining a sense of order in a chaotic situation. After extensive surgery to stabilize and reduce his multiple fractures, the patient was transferred to the ICU.

In the ICU, he continued to receive outstanding care. Although his multiple fractures and internal injuries had been addressed in the OR, the struggle for his recovery continued. The flight surgeons coordinated his CCAT team flight to Landstuhl Regional Medical Center in Germany for continuation of his care and recovery. During his recovery, this patient was followed closely by a group of nurses and providers who had been "adopted" by the patient's friends and fellow service members for their work in saving his life. His progress was sporadically reported to us throughout our deployment. Hearing from a wounded patient for whom a medic has cared is a humbling and rewarding experience. It is

immensely satisfying to see a patient make progress from an initially dire situation. With great pride and hope, we later read a Christmas greeting card from this patient, with a photo of him standing on both legs at Walter Reed Hospital. In the tumult of the ER, a medic has only one focus: to save a life. Knowing that one's efforts have paid off is professionally and personally rewarding.

#### *Situation #4*

One challenge of working in a deployed military situation is that one never knows who or what clinical situation will come through the door. A case in point was a critically ill child brought to the front gate of the base. She had a high fever and respiratory distress that called for immediate medical intervention. A child in an EMEDS unit can pose a problem on the best of days. Military medics are accustomed to working on adults, but caring for children requires a different mind-set and specific pediatric equipment. However, this life-and-death situation spurred us on to improvise and create supplies to work on such a small patient. With some ingenuity and teamwork, the improvised supplies allowed us to deliver outstanding care that resulted in the successful management of the clinical situation. This 1-year-old infant had clearly been septic, with an extremely high fever and respiratory distress. Her clinical situation improved with antibiotics and antipyretics. The source that contributed to her infection was identified by

telemedicine, whereby a radiologist stationed at another base identified an abdominal tumor.

#### **Summary**

Military members who carry a stethoscope are proud to be called "medic." They all accept their role as bringing good medicine to a difficult place for well-deserving warriors. EMEDS doctors and nurses must always be prepared for the worst-case scenario, with no notice, and multiple casualties [11]. During my career, I have forged many strong relationships while caring for patients in the most difficult of circumstances, and have grown to appreciate the contributions of a well-organized and dedicated group of individuals. No matter how difficult the environment and circumstances, this EMEDS team provided the best possible medical care to all who passed through its door (Fig. 12).

The distinct thumping of the rotary blades of a military helicopter is recognizable from a distance, and as it approaches, the cadence of those blades conjures up memories of the mission and the purpose of our work as deployed medics. In the M\*A\*S\*H series, just the word "choppers" over the loudspeaker set medics into motion to care for the military's most valuable assets. The sound of choppers today still provokes this feeling in all medics who have served in a combat zone. The rewards for medics are deep and rich: knowing firsthand that the care provided in the most critical of situations can translate into the



Fig. 12. Bringing the wounded into the ER of EMEDS.



Fig. 13. Outside 407th AEG EMEDS.

successful recovery of a fellow warrior. Nurses in deployed settings bring a great deal of knowledge and clinical competence to their work, whether in an EMEDS unit or as part of a CCAT team. Capturing the rich experience and lessons learned is of great importance as nurses continue to provide patient care on the front lines. Success means being prepared to do one's job in the most austere environment and against incredible obstacles, while always remaining flexible (Fig. 13).

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